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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/911,898	07/24/2001	Jay N. Damask	YAFO-7	3713

7590 06/30/2003

STEPHEN R. WHITT  
1215 TOTTENHAM COURT  
RESTON, VA 20194

EXAMINER

CONNELLY CUSHWA, MICHELLE R

ART UNIT PAPER NUMBER

2874

DATE MAILED: 06/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.



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34753 7590 06/10/2003

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EXAMINER

CONNELLY CUSHWA, MICHELLE R

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# Office Action Summary

Application No.

09/911,898

Applicant(s)

DAMASK, JAY N.

Examiner

Michelle R. Connelly-Cushwa

Art Unit

2874

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-55 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,5,6,10-19,21-26,28,32-36 and 46-55 is/are rejected.
- 7) ☒ Claim(s) 4,7-9,20,27,29-31 and 37-45 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Drawings*

Seventeen (17) sheets of formal drawings were filed on July 31, 2000 and have been accepted by the Examiner.

### *Specification*

Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

**Claims 13-19 and 47-53 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.**

Regarding claim 13; the claim recites the limitation "said turning element " in lines 1-2 of claim 13. There is insufficient antecedent basis for this limitation in the claim. Examiner suggests changing "claim 1" in line 1 of claim 13 to —claim 12—to overcome this rejection.

Regarding claim 14; the claim recites the limitation "said second amount of polarization retardation" in lines 1-2 of claim 14. There is insufficient antecedent basis for this limitation in the claim. Examiner suggests incorporating a limitation defining a second amount of polarization retardation into claim 13, from which claim 14 depends, to overcome this rejection.

Regarding claim 19; the claim recites the limitation "said second amount of polarization retardation" in lines 2-3 of claim 19. There is insufficient antecedent basis for this limitation in the claim. Examiner suggests incorporating a limitation defining a second amount of polarization retardation into claim 13, from which claim 19 depends, to overcome this rejection.

Regarding claim 47; the claim recites the limitation "said light beam" in line 3 of claim 47. There is insufficient antecedent basis for this limitation in the claim. Examiner suggests changing "said light beam" to -a light beam—to overcome this rejection.

Regarding claim 48; the claim contains the limitations "adding...before said adding" in lines 2-3 of claim 48 and "adding... before said further adding" in lines 4-6 of claim 48. Examiner suggests adopting terminology that will allow the different adding steps and their sequence to be more easily determined, especially since claim 48 is referring back to adding steps in claim 47.

Regarding claim 51; the claim contains the limitations "said generator" and "said turning prism" in lines 3-4 of claim 51. There is insufficient antecedent basis for this limitation in the claim. Examiner suggests changing "said generator" to -a PMD generator—and changing "said turning prism" to -said turning assembly—to overcome this rejection.

Regarding claims 15-18, 49, 50, 52 and 53; the claims inherently contain the deficiencies of any base or intervening claims from which they depend.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

**Claims 1-3, 5, 10-12, 21-26, 34 and 54 are rejected under 35 U.S.C. 102(e) as being anticipated by Cao (US 6,538,815 B1).**

Regarding claims 1-3, 5, 10-12, 21-26, 34 and 54; Figures 11 and 12 of Cao disclose an optical device comprising:

- a lens assembly (805, 806, 807, 808) for receiving/transmitting light beams from/to input/output fibers (801, 802, 803, 804);
- a beam turning assembly (1240 and 1280A, 1220 and 1280B) for the redirection of the light beam from an input fiber to an output fiber; and
- a variable PMD generating assembly located between the lens assembly and the beam-turning assembly, wherein the PMD generating assembly comprises a fixed DGD stage (passive birefringent elements: 809, 812) and a variable retardation stage (1290 and 1295);

- wherein the lens assembly (805, 806, 807, 808) is located at a first end of the device and the beam turning assembly (reflectors/mirrors: 1240 and 1280A, 1220 and 1280B) is located at a second end of the device;
- wherein the PMD generating stage (1290 and 1295) is located between the fixed stage (809, 812) and the turning assembly (1240 and 1280A, 1220 and 1280B);
- wherein the turning assembly can reverse the direction of the beam an odd number of times (one) and the lens assembly comprises a two-fiber collimator (815), and the fiber collimator (815) includes dual input/output fibers (801 and 802, 803 and 804);
- wherein the lens assembly further comprises a support structure (four-fiber ferrule, 815) that holds the input/output fibers (801, 802, 803, 804) such that they are substantially parallel to each other and such that the fibers are at a predetermined center-to-center spacing such that the focal planes of the fibers are substantially coplanar;
- wherein the lens assembly further comprises a lens array (805, 806, 807, 808) comprising first, second, third and fourth lenses positioned at ends of the input/output fibers for collecting and focusing light returning to the lens assembly;
- wherein the passive birefringent elements (809, 812) exhibit birefringence in a plane perpendicular to the direction of the beam

within the birefringent elements and the extraordinary crystalline axis is orientated substantially in the plane;

- wherein the birefringence of one of the birefringent elements (809, 812) is smaller than the birefringence of the other of the birefringent elements; and
- wherein the turning assembly has a vertex axis and the fixed DGD stage has a birefringence axis that has an orientation of about 45 degrees with respect to the vertex axis (see Figures 11 and 12).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**Claims 6, 13, 14, 28, 32 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,538,815 B1).**

Regarding claim 6; Cao discloses all of the limitations of claim 6 as applied above, except for the collimator comprising a single lens. It would have been obvious to one having ordinary skill in the art at the time the invention was made to substitute a single lens in place of the multiple lenses disclosed by Cao, since the use of a single collimator is equivalent to the use of individual collimators; it is common practice in the art to reduce the number of optical components in an optical device by replacing multiple independent collimators with a single collimator, thereby reducing the size and



cost of an optical device; and the selection of any of these known equivalents is within the level of ordinary skill in the art.

Regarding claims 13 and 14; Cao discloses all of the limitations of claims 13 and 14 as applied above, except for specifically stating that the waveplates substantially nullify the first amount of polarization retardation provided by the turning element. The variable retardation of the waveplates (1295, 1290) is chosen to control the output properties of the signal (1230) after reflection from the turning element. Therefore, one of ordinary skill in the art would have found it obvious to use the waveplates (1295, 1290) to nullify the first amount of polarization retardation provided by the turning element if so desired, thereby having the second amount of polarization retardation be equal in magnitude and opposite in direction to the first amount of polarization in order to nullify the first amount of polarization, since Cao teaches that the waveplates may be used to control the output properties of the signal after reflection from the turning element.

Regarding claims 28, 32 and 33; Cao discloses all of the limitations of these claims as applied above, except for specifically stating what material the birefringent elements are made from. Cao does not teach that birefringent elements of any specific material are used in the invention. Birefringent elements comprised of yttrium orthovanadate, lithium niobate, rutile, calcite, alpha-barium borate, mica, crystalline quartz, and combinations thereof are commonly used and very elementary in the art. One of ordinary skill in the art would have found it obvious to incorporate birefringent elements of any known materials in the invention of Cao, since Cao does not teach that a specific

material is used. Therefore, one of ordinary skill in the art would have found it obvious to incorporate birefringent elements made from yttrium ortho-vanadate, lithium niobate, rutile, calcite, alpha-barium borate, mica, crystalline quartz, or combinations thereof in the invention of Cao.

**Claims 35, 36, 46 and 47-49 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,538,815 B1) in view of Shimizu (US 4,898,441) and Bismuth et al. (US 6,188,809 B1).**

Regarding claims 35, 46 and 47-49; Cao teaches all of the limitations these claims as applied to claim 1 above, except for the variable retardation stage comprising at least one electro-optic element constructed from an electro-optic material. Electro-optic materials selected from the group consisting of lithium niobate, potassium titanium phosphate, rubidium titanium phosphate, rubidium titanium arsenate, lead zirconium lanthanum, and combinations thereof are well known and commonly used in the art to create electro-optic variable retardation plates and devices. (For example, see the disclosures of Bismuth et al. and Shimizu). Cao does not disclose what type of specific variable retardation device is employed in the invention, but Cao only discloses that phase retardation of the plates (1295 and 1290) is varied to control the output of the signal. Therefore, one of ordinary skill in the art would have found it obvious to incorporate any known variable retardation plates in the invention of Cao, including electro-optic variable retardation plates formed from well known electro-optic materials, since such devices are known in the art; it appears that the invention would perform

equally well with any known variable retardation plates; and Cao does not disclose or suggest that specific variable retardation plates are used.

Regarding claim 36; electro-optic variable retardation plates/devices, including those disclosed by Bismuth et al. and Shimizu, exhibit voltage-induced birefringence in a plane perpendicular to the direction of light beams traveling therethrough.

**Claim 55 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,538,815 B1) in view of Fishman et al. (US 5,930,414) and Damask (US 6,377,719 B1).**

Regarding claim 55; Cao discloses all of the limitations of claim 55 as applied to claim 1 above, except for the PMD generator being incorporated in a PMD compensator having a receiver and error generator optically coupled to the output of the PMD generator, and a control signal generator optically coupled to the receiver and error generator and to the PMD generator. PMD compensation systems including PMD generators coupled to receiver and error generators and control signal generators coupled between receiver and error generators and PMD generators are conventional in the art (see Figure 1 of Fishman et al.; Figure 18 of Damask; Figure 2 of the present application, and the corresponding descriptions). Thus, one of ordinary skill in the art would have been familiar with PMD compensation systems and would have found it obvious to incorporate the PMD generator disclosed by Cao in any PMD compensation system, including both a receiver and error generator coupled to the output of the PMD generator and a control signal generator coupled between the receiver and error

generator and the PMD generator, since this is a conventional arrangement within the art.

***Allowable Subject Matter***

**Claims 4, 7-9, 20, 27, 29-31 and 37-45 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.**

**Claims 15-19 and 50-53 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.**

The following is a statement of reasons for the indication of allowable subject matter: The prior art cited on attached form PTO-892 is the most relevant prior art known, however, the invention of claims 4, 7-9, 15-20, 27, 29-31, 37-45 and 50-53 distinguishes over the prior art of record for the following reasons.

Regarding claim 4; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 4, wherein the turning assembly can reverse the direction of the beam an even number of times and the lens assembly comprises an input collimator at one end of the generator and an output collimator at another end of the generator in combination with the limitations of the base and intervening claims.

Regarding claims 7-9; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 7, the lens assembly comprising a straightening

prism between the collimator and the variable PMD generating assembly, and wherein the straightening prism is positioned such that the beam, directly after passing through the straightening prism a first time, is substantially parallel to the beam, directly before passing through the straightening prism a second time in combination with the limitations of the base and intervening claims. Claims 8 and 9 depend from claim 7.

Regarding claims 15 and 16; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 15, wherein the phase-compensating waveplate comprises at least one compensator having an e-axis in combination with the limitations of the base and intervening claims. Claim 16 depends from claim 15.

Regarding claims 17 and 18; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 17, wherein the at least one element comprises a plurality of elements, each of the elements having an e-axis that has an orientation to prevent mode mixing as the beam travels from a first of the elements to a second of the elements in combination with the limitations of the base and intervening claims. Claim 18 depends from claim 17.

Regarding claim 19; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 19, wherein the light beam has a wavelength and the second amount of polarization retardation causes the turning assembly to add

approximately an integral number of the wavelengths in combination with the limitations of the base and intervening claims.

Regarding claim 20; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 20, wherein the turning element is a two-part prism that comprises a first prism part and a second prism part and has a vertex axis, wherein the turning assembly further comprises a mixing half wave waveplate located between the first and second prism parts, and wherein the waveplate has an e-axis orientation with respect to the vertex axis of about +45 degrees in combination with the limitations of the base and intervening claims.

Regarding claim 27; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 27, further comprising a mixing half wave waveplate having an e-axis with an orientation with respect to the vertex axis selected from a group consisting of about +22.5 degrees, about -22.5 degrees, about +67.5 degrees, and about -67.5 degrees in combination with the limitations of the base and intervening claims.

Regarding claims 29-31; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 29, wherein the at least one element comprises a combination of a first element having a first thermal expansion coefficient and a second element having a second thermal expansion coefficient, each of the elements

comprising at least one material, wherein the combination has a thermal expansion coefficient that is less than the first and second coefficients individually in combination with the limitations of the base and intervening claims. Claims 30 and 31 depend from claim 29.

Regarding claims 37-39 and 44; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 37, wherein the at least one electro-optic element comprises a plurality of electro-optic elements, each of the electro-optic elements having a p-axis that has an orientation to substantially prevent mode mixing as the beam travels from a first of the electro-optic elements to a second of the electro-optic elements in combination with the limitations of the base and intervening claims. Claims 38, 39 and 44 depend from claim 37.

Regarding claims 40-43; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 40, wherein the variable retardation stage comprises two groups of at least one electro-optic element having an anode and a cathode, each element having an intrinsic birefringence and a voltage-induced birefringence that occurs when a voltage is applied between the anode and the cathode, and wherein the groups are orientated such that the first group intrinsic birefringence cancels the second group intrinsic birefringence and the first group voltage-induced birefringence adds to the second group voltage-induced birefringence in combination

with the limitations of the base and intervening claims. Claims 41-43 depend from claim 40.

Regarding claim 45; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a generator as defined in claim 45, wherein the variable retardation assembly further comprises a mixing half wave waveplate located between the fixed DGD stage and the variable retardation stage, wherein the turning assembly has a vertex axis, the variable retardation stage has a voltage-induced p-axis that has an orientation with respect to the vertex axis selected from a group consisting of a substantially parallel orientation and a substantially perpendicular orientation, the fixed DGD stage has a birefringent axis that has an orientation with respect to the vertex axis selected from a group consisting of a substantially parallel orientation and a substantially perpendicular orientation and the mixing half-wave waveplate has an e-axis orientation with respect to the vertex axis selected from a group consisting of about +22.5 degrees, about -22.5 degrees, about +67.5 degrees, and about -67.5 degrees in combination with the limitations of the base and intervening claims.

Regarding claim 50; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 50, wherein the plurality of crystals further comprises a third type of crystal having a birefringence that is less than the first and second birefringences, wherein the adding a fixed amount of retardation and the adding the same fixed amount of retardation further comprises adding a predetermined differential



amount of retardation when the light passes through the third type of crystal to ensure that the fixed amount is accurate in combination with the limitations of the base and intervening claims.

Regarding claims 51-53; the claims are allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a method as defined in claim 51, wherein the turning assembly further comprises a phase-compensating waveplate along the optical path of the generator and the turning prism provides a first amount of polarization retardation to the optical beam, and wherein the method further comprises substantially nullifying the first amount of polarization retardation by providing a second amount of polarization retardation in combination with the limitations of the base and intervening claims. Claims 52 and 53 depend from claim 51.

Hence, there is not reason or motivation for one of ordinary skill in the art to use the prior art of record to make the invention of claims 4, 7-9, 15-20, 27, 29-31, 37-45 and 50-53.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Albert et al. (US 6,504,642 B1) discloses a birefringent optical device and Chen et al. (US 2002/0085252 A1) discloses an device with differential retardation effects employing non-birefringent elements.

Any inquiry concerning the merits of this communication should be directed to Examiner Michelle R. Connelly-Cushwa at telephone number (703) 305-5327. Any

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inquiry of a general or clerical nature (i.e. a request for a missing form or paper, etc.) should be directed to the Technology Center 2800 receptionist at telephone number (703) 308-0956 or to the technical support staff supervisor at telephone number (703) 308-3072.

Michelle R. Connelly-Cushwa

**MRCC**  
May 27, 2003

  
**AKM ENAYET ULLAH**  
**PRIMARY EXAMINER**